

1/15

## SEQUENCE LISTING

<110> INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE  
THE INSTITUTE FOR GENOMIC RESEARCH

<120> EAST COAST FEVER VACCINE BASED ON CTL-SPECIFIC  
SCHIZONT ANTIGENS

<130> 41860-205199

<140>

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<150> 60/504,428

<151> 2003-09-22

<160> 53

<170> PatentIn Ver. 3.2

<210> 1

<211> 174

<212> PRT

<213> Theileria parva

<220>

<223> Amino acid sequence of Tp2:

<400> 1

Met	Lys	Leu	Ala	Ala	Arg	Leu	Ile	Ser	Leu	Tyr	Phe	Ile	Ile	Tyr	Ile
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Leu	His	Ser	Pro	Val	Leu	Gly	Gly	Asn	Cys	Ser	His	Glu	Glu	Leu	Lys
			20					25					30		
Lys	Leu	Gly	Met	Leu	Glu	Gly	Asp	Gly	Phe	Asp	Arg	Asp	Ala	Leu	Phe
		35					40				45				
Lys	Ser	Ser	His	Gly	Met	Gly	Lys	Val	Gly	Lys	Arg	Tyr	Gly	Leu	Lys
	50					55					60				
Thr	Thr	Pro	Lys	Val	Asp	Lys	Val	Leu	Ala	Asp	Leu	Glu	Thr	Leu	Phe
	65				70					75					80
Gly	Lys	His	Gly	Leu	Gly	Gly	Ile	Ser	Lys	Asp	Cys	Leu	Lys	Cys	Phe
			85						90					95	
Ala	Gln	Ser	Leu	Val	Cys	Val	Leu	Met	Lys	Cys	Arg	Gly	Ala	Cys	Leu
			100					105					110		
Lys	Gly	Pro	Cys	Thr	Asp	Asp	Cys	Gln	Asn	Cys	Phe	Asp	Arg	Asn	Cys
		115					120					125			
Lys	Ser	Ala	Leu	Leu	Glu	Cys	Ile	Gly	Lys	Thr	Ser	Ile	Pro	Asn	Pro
	130					135					140				
Cys	Lys	Trp	Lys	Glu	Asp	Tyr	Leu	Lys	Tyr	Lys	Phe	Pro	Glu	Thr	Asp
145					150					155					160

2/15

Glu Asp Glu Ser Thr Lys Lys Gly Glu Ala Ser Gly Thr Ser  
                                   165                                  170

&lt;210&gt; 2

&lt;211&gt; 265

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of Tp3

&lt;400&gt; 2

Met Lys Leu Asn Thr Ile Ala Ile Ala Phe Leu Tyr Ser Cys Phe Ser  
   1                                  5                                  10                                  15

Gln Phe Leu Lys Asn Val Ser Ala Leu Arg Arg Ser Ser Pro Asp Leu  
                                   20                                  25                                  30

Ser Pro Asp Gly Ser Phe Leu Gln Val Lys Ser Ala Ser Pro Gln Asp  
                                   35                                  40                                  45

Lys Gln Asp Val Ile Gln Ser Ser Ser Pro Lys Val Thr Val Pro Thr  
   50                                  55                                  60

Val Asp Pro Glu Gly Leu Lys Lys Ala Val Thr Ala Ala Val Leu Ser  
   65                                  70                                  75                                  80

Asn Gln Asn Gln Ala Leu Gln Asn Gly Ala Leu Asn Pro Ala Asp Phe  
                                   85                                  90                                  95

Thr Gln Ala Ala Ser Val Asn Ser Met Ser Asn Ala Val Ser Ala Met  
                                   100                                  105                                  110

Asn Asn Thr Val Gly Pro Val Lys Asn Pro Met Ala Thr Val Gly Thr  
                                   115                                  120                                  125

Met Asn Ser Phe Thr Gly Met Pro Gly Val Gln Asp Asn Phe Pro Gln  
   130                                  135                                  140

Thr Pro Pro Val Asn Val Gln Asp Thr Ser Thr Gln Glu Asn Ser Leu  
   145                                  150                                  155                                  160

Asp Asn Leu Asn Leu Leu Leu Asp Pro Ser Leu Val Lys Ile Ser Gln  
                                   165                                  170                                  175

Ala Asp Ser His Ile Lys Glu Ser Met Glu Lys Ala Val His Ser Leu  
                                   180                                  185                                  190

Lys Lys Val Leu Glu Gly Leu Thr Asn Leu Ala Thr Leu Ser Lys Ser  
   195                                  200                                  205

Arg Asp Thr Glu Pro Phe Asn Val Leu Gly Asp Asp Tyr Thr Met Arg  
   210                                  215                                  220

Asn Val Leu Asp Leu Met Asn Lys Glu Leu Arg Gln Val Glu Ser Leu  
   225                                  230                                  235                                  240

3/15

Gln Lys Val Val Phe Gln Phe Asn Ala Phe Ala Leu Ser Thr Phe Thr  
245 250 255

Lys Ser Pro Asp Asp Asn Lys Lys Ser  
260 265

<210> 3

<211> 277

<212> PRT

<213> Theileria parva

**<220>**

<223> Amino acid sequence of Tp6

<400> 3

Met Ala Gln Ile Pro Val Asp Lys Phe Ala Lys Leu Val Thr Gly Ala  
1 5 10 15

Gly Ser Ala Leu Leu Leu Phe Gly Ser Gly Ala Trp Leu Val Asn Ser  
20 25 30

Ser Leu Tyr Asp Val Gly Ala Gly His Arg Ala Val Val Tyr Asn Arg  
35 40 45

Ile Thr Gly Ile Ser Glu Thr Thr His Gly Glu Gly Thr His Phe Ile  
50 55 60

Ile Pro Trp Leu Glu Arg Pro Ile Ile Tyr Asp Val Arg Thr Arg Pro  
65 70 75 80

Arg Thr Leu Met Ser Leu Thr Gly Ser Arg Asp Leu Gln Met Val Asn  
85 90 95

Ile Thr Cys Arg Val Leu Ser Arg Pro Asp Glu Arg Arg Leu Arg Asp  
100 105 110

Ile Tyr Arg His Leu Gly Lys Asp Tyr Asp Glu Arg Val Leu Pro Ser  
115 120 125

Ile Ile Asn Glu Val Leu Lys Ser Ile Val Ala Gln Tyr Asn Ala Ser  
130 135 140

Gln Leu Ile Thr Gln Arg Glu Arg Val Ser Lys Ala Val Arg Asp Gln  
145 150 155 160

Leu Val Asn Arg Ala Arg Asp Phe Asn Ile Leu Leu Asp Asp Val Ser  
165 170 175

Leu Thr His Leu Ser Phe Ser Pro Glu Tyr Glu Lys Ala Val Glu Ala  
180 185 190

Lys Gln Val Ala Gln Gln Gln Ala Glu Arg Ser Lys Tyr Ile Val Leu  
195 200 205

Lys Ala Gln Glu Glu Lys Lys Ser Thr Ile Ile Lys Ala Gln Gly Glu  
210 215 220

4/15

Ser Glu Ala Ala Arg Leu Ile Gly Ser Ala Ile Lys Asp Asn Pro Ala  
225 230 235 240

Phe Ile Thr Leu Arg Arg Ile Glu Thr Ala Lys Glu Val Ala Asn Ile  
245 250 255

Leu Ser Lys Ser Gln Asn Lys Ile Met Leu Asn Ser Asn Thr Leu Leu  
260 265 270

Leu Ser Thr Asp Lys  
275

&lt;210&gt; 4

&lt;211&gt; 9

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of Tp2 Epitope 1 (Tp2.4)

&lt;400&gt; 4

Gln Ser Leu Val Cys Val Leu Met Lys  
1 5

&lt;210&gt; 5

&lt;211&gt; 9

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of Tp2 Epitope 2 (Tp2.2)

&lt;400&gt; 5

Phe Ala Gln Ser Leu Val Cys Val Leu  
1 5

&lt;210&gt; 6

&lt;211&gt; 11

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of Tp2 Epitope 3 (Tp2.3)

&lt;400&gt; 6

Lys Ser Ser His Gly Met Gly Lys Val Gly Lys  
1 5 10

&lt;210&gt; 7

&lt;211&gt; 11

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

5/15

&lt;220&gt;

&lt;223&gt; Amino acid sequence of Tp2 Epitope 4 (Tp2.4)

&lt;400&gt; 7

Ser His Glu Glu Leu Lys Lys Leu Gly Met Leu  
1 5 10

&lt;210&gt; 8

&lt;211&gt; 12

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of peptide of Tp2

&lt;400&gt; 8

Cys Ser His Glu Glu Leu Lys Lys Leu Gly Met Leu  
1 5 10

&lt;210&gt; 9

&lt;211&gt; 14

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of peptide #43 of Tp2

&lt;400&gt; 9

Phe Lys Ser Ser His Gly Met Gly Lys Val Gly Lys Arg Tyr  
1 5 10

&lt;210&gt; 10

&lt;211&gt; 14

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of peptide #53/54 of Tp2

&lt;400&gt; 10

Phe Lys Ser Ser His Gly Met Gly Lys Val Gly Lys Arg Tyr  
1 5 10

&lt;210&gt; 11

&lt;211&gt; 14

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence of peptide #78/79 of Tp2

&lt;400&gt; 11

Phe Ala Gln Ser Leu Val Cys Val Leu Met Lys Cys Arg Gly  
1 5 10

6/15

<210> 12  
<211> 14  
<212> PRT  
<213> Theileria parva

<220>  
<223> Amino acid sequence of peptide #77/78 of Tp2

<400> 12  
Lys Cys Phe Ala Gln Ser Leu Val Cys Val Leu Met Lys Cys  
1 5 10

<210> 13  
<211> 10  
<212> PRT  
<213> Theileria parva

<220>  
<223> Amino acid sequence of peptide of Tp2

<400> 13  
Ser Ser His Gly Met Gly Lys Val Gly Lys  
1 5 10

<210> 14  
<211> 12  
<212> PRT  
<213> Theileria parva

<220>  
<223> Amino acid sequence of peptide #77 of Tp2

<400> 14  
Lys Cys Phe Ala Gln Ser Leu Val Cys Val Leu Met  
1 5 10

<210> 15  
<211> 12  
<212> PRT  
<213> Theileria parva

<220>  
<223> Amino acid sequence of peptide #36 used as  
an experimental control

<400> 15  
Phe Ile Ile Tyr Ile Leu His Ser Pro Val Leu Gly  
1 5 10

<210> 16  
<211> 9  
<212> PRT

7/15

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence of synthesized peptide named #75,  
representing amino acid residues 97 through 105 of Tp2

&lt;400&gt; 16

Ala Gln Ser Leu Val Cys Val Leu Met  
1 5

&lt;210&gt; 17

&lt;211&gt; 9

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence OF PEPTIDE #76 of Tp2

&lt;400&gt; 17

Ser Leu Val Cys Val Leu Met Lys Cys  
1 5

&lt;210&gt; 18

&lt;211&gt; 8

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence representing amino acid residues  
numbers 98 through 105 of Tp2

&lt;400&gt; 18

Gln Ser Leu Val Cys Val Leu Met  
1 5

&lt;210&gt; 19

&lt;211&gt; 9

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence representing amino acid residues  
numbers 99 through 107 of Tp2

&lt;400&gt; 19

Phe Gly Lys His Gly Leu Gly Gly Ile  
1 5

&lt;210&gt; 20

&lt;211&gt; 10

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

8/15

&lt;220&gt;

<223> Amino acid sequence for peptide fragment of  
A.A.#49-A.A.#58 of Tp2

&lt;400&gt; 20

Lys Ser Ser His Gly Met Gly Lys Val Gly  
1 5 10

&lt;210&gt; 21

&lt;211&gt; 8

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence for peptide fragment of  
A.A.#97-A.A.#104 of Tp2

&lt;400&gt; 21

Ala Gln Ser Leu Val Cys Val Leu  
1 5

&lt;210&gt; 22

&lt;211&gt; 12

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence for peptide fragment of  
A.A.#97-A.A.#104 of Tp2

&lt;400&gt; 22

Gly Asn Cys Ser His Glu Glu Leu Lys Lys Leu Gly  
1 5 10

&lt;210&gt; 23

&lt;211&gt; 12

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Amino acid sequence for peptide fragment of  
A.A.#28-A.A.#39 of Tp2

&lt;400&gt; 23

His Glu Glu Leu Lys Lys Leu Gly Met Leu Glu Gly  
1 5 10

&lt;210&gt; 24

&lt;211&gt; 8

&lt;212&gt; PRT

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Amino acid sequence for peptide fragment of Tp1

1



9/15

representing amino acid residues #96 to amino acid #103

&lt;400&gt; 24

Phe Ala Gln Ser Leu Val Cys Val

1

5

&lt;210&gt; 25

&lt;211&gt; 525

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp2

&lt;400&gt; 25

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atgaaattgg cgcagatt aattagcctt tactttatta ttacatttt acattcccca 60
gtgctgggag gtaattgtag tcatgaagaa ctaaaaaaat tgggaatgct agagggcgat 120
ggtttcgaca gggatgcatt gttcaaata tcacatggta tgggaaagg aggaaaaagg 180
tatggtctta aaactactcc aaaagtagat aaagtcttag cagatcttga aacactgttt 240
ggaaaacacg gtcttggtgg tattagtaaa gattgtctta aatgttttgc acaaagccta 300
gtgtgcgtat taatgaaatg tagaggagca tgtctcaaag gaccatgtac tgacgactgc 360
caaaattgct ttgatagaaa ctgtaaatct gcattgctgg aatgcattgg gaaaacaagt 420
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gaggacgaat ctacgaaaaa aggagaagcc tccggcactt catag 525

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&lt;210&gt; 26

&lt;211&gt; 798

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp3

&lt;400&gt; 26

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atgaaattaa atactatcgc aatagccttt ttgtattcct gtttctcaca gtttttaaaa 60
aatgtgtctg ctctgaggcg tagttctcca gatgtgtcac cagatgggtc ttttcttcaa 120
gtaaaatcag cttctcctca ggataaacia gatgtaatcc aaagtctctc tcctaaggta 180
acagtgccta cggttgacct tgaaggcctc aagaaggcgg ttactgcagc agttctatca 240
aaccaaaatc aagctctaca aaacgggtct cttaatccag cagatttcac tcaagctgcc 300
tctgttaatt ccatgagtaa tgctgttagt gccatgaaca atactgttg tccagtaaaa 360
aatcccatgg ctactgttgg tactatgaac tcctttactg gaatgcctgg tgtacaggat 420
aattttcctc agacaccgcc tgtaaatgtt caagacacct ctaccagga gaacagtctt 480
gacaacctaa atctcctctt agatccctcg ttagtaaaga tatctcaagc tgatagtcac 540
ataaaagaaa gcatggaaaa agctgtacac agccttaaaa aggtcttggg ggggctaacc 600
aaccttgcca ctctgtctaa aagtagggat actgaaccgt ttaatgttct gggggatgac 660
tatacgatgc gtaacgtttt ggacctcatg aataaggaac tcaggcagg tgaatctctt 720
cagaaagttg tgttccaatt caacgccttt gcactttcca ccttcactaa gagtccagac 780
gataataaaa aatcctaa 798

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&lt;210&gt; 27

&lt;211&gt; 834

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp6

10/15

&lt;400&gt; 27

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atggctcaga ttctgttga taaattcgct aaattagtta ctggagccgg ctctgctctc 60
ttattattcg gttcagggtgc ctggcttgct aattccagtt tatacgatgt tggagctggg 120
catagagctg ttgtatataa ccgtatcact ggaataagtg agactacaca tggagaagga 180
acgcacttca taattccctg gctagaacgt ccaataattt acgatgtgag gactcgtcct 240
aggactctga tgtctctcac cggaagccgt gacttgacaga tggttaacat cacctgccgt 300
gtgttgcttc gtcccgatga gcgcagactc agggatatct acaggcactt gggcaaagat 360
tacgacgagc gagtccctgcc ttcaataata aacgagggtc tgaagagtat tgtggcccag 420
tacaacgcct ctacgtcat tactcagaga gaaagagtta gcaaagcagt caggggaccag 480
ctggtgaaca gggccaggga ctttaatat cttctcgatg atgtctcctt aaccctacta 540
agcttcagtc ctgaatatga aaaggctgta gaggctaaac aagtagctca acagcaagct 600
gaacgcagta aatatatagt gttgaaggct caggaggaga agaaatcgac gataattaag 660
gctcagggag agtctgaggc tgcaaggctt attggaagtg caattaagga taaccctgcc 720
tttattacgc ttcggaagaat tgaaaccgct aagggaagtgg ctaacattct ctccaaatcg 780
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&lt;210&gt; 28

&lt;211&gt; 27

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence Tp2 Epitope 1 (Tp2.1)

&lt;400&gt; 28

caaaagcctag tgtgcgtatt aatgaaa

27

&lt;210&gt; 29

&lt;211&gt; 27

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp2 Epitope 2 (Tp2.2)

&lt;400&gt; 29

tttgcacaaa gcctagtgtg cgtatta

27

&lt;210&gt; 30

&lt;211&gt; 33

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp2 Epitope 3 (Tp2.3)

&lt;400&gt; 30

aaatcatcac atggtatggg aaaggtagga aaa

33

&lt;210&gt; 31

&lt;211&gt; 33

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

11/15

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp2 Epitope 4 (Tp2.4)

&lt;400&gt; 31

agtcatgaag aactaaaaaa attgggaatg cta

33

&lt;210&gt; 32

&lt;211&gt; 22

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Nucleotide sequence Tp2 forward primer for  
expression cloning

&lt;400&gt; 32

ggtaattgta gtcataaga ac

22

&lt;210&gt; 33

&lt;211&gt; 24

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Nucleotide sequence Tp2 reverse primer for  
expression cloning

&lt;400&gt; 33

tttactaata ccaccaagac cgtg

24

&lt;210&gt; 34

&lt;211&gt; 37

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence Tp2 forward primer for gene cloning

&lt;400&gt; 34

gccgccacca tgaaattggc cgccagatta attagcc

37

&lt;210&gt; 35

&lt;211&gt; 39

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence Tp3 forward primer for gene cloning

&lt;400&gt; 35

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39

12/15

<210> 36  
<211> 37  
<212> DNA  
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<220>  
<223> Nucleotide sequence Tp6 forward primer for gene cloning

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<210> 37  
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<220>  
<223> Nucleotide sequence Tp2 reverse primer for gene cloning

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<210> 38  
<211> 28  
<212> DNA  
<213> Theileria parva

<220>  
<223> Nucleotide sequence Tp3 reverse primer for gene cloning

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<210> 39  
<211> 31  
<212> DNA  
<213> Theileria parva

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<223> Nucleotide sequence Tp6 reverse primer for gene cloning

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<210> 40  
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<212> DNA  
<213> Theileria parva

<220>  
<223> Nucleotide sequence Tp2 internal forward primer for  
gene cloning

13/15

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<210> 41  
<211> 26  
<212> DNA  
<213> Theileria parva

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<223> Nucleotide sequence Tp2 forward primer for gene cloning

<400> 41  
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<210> 42  
<211> 24  
<212> DNA  
<213> Theileria parva

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<223> Nucleotide sequence Tp2 forward primer for gene cloning

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<210> 43  
<211> 23  
<212> DNA  
<213> Theileria parva

<220>  
<223> Nucleotide sequence of vector-specific forward primer

<400> 43  
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<210> 44  
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<220>  
<223> Nucleotide sequence of vector-specific reverse primer

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<210> 45  
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<213> Theileria parva

14/15

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp3-specific forward primer

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33

&lt;210&gt; 46

&lt;211&gt; 32

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp3-specific reverse primer

&lt;400&gt; 46

cgccctcgagg gattttttat tatcgtctgg ac

32

&lt;210&gt; 47

&lt;211&gt; 33

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp6-specific forward primer

&lt;400&gt; 47

cgcgctagcg ccgccacat ggctcagatt cct

33

&lt;210&gt; 48

&lt;211&gt; 32

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

&lt;223&gt; Nucleotide sequence of Tp6-specific reverse primer

&lt;400&gt; 48

gcgctcgagt ttatcagttg agagtaagag ag

32

&lt;210&gt; 49

&lt;211&gt; 33

&lt;212&gt; DNA

&lt;213&gt; Theileria parva

&lt;220&gt;

<223> Nucleotide sequence of specific forward primer for  
adding a tag (HIS) to gene sequences

&lt;400&gt; 49

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33

&lt;210&gt; 50

&lt;211&gt; 35

15/15

<212> DNA  
<213> Theileria parva

<220>  
<223> Nucleotide sequence of specific reverse primer for  
adding a tag (HIS) to gene sequences

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<213> Theileria parva

<220>  
<223> Nucleotide sequence of specific forward primer for  
PCR amplification of Tp3 sequences

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<210> 52  
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<213> Theileria parva

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<223> Nucleotide sequence of specific reverse primer for  
PCR amplification of Tp3-pTargetT sequences

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PCR amplification of Tp6 sequences

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